

BULLETIN

OF THE INSTITUTE OF METALS

VOLUME 2

APRIL 1955

PART 20

INSTITUTE NEWS

Autumn Meeting, Buxton, 19-23 September

The following firms have kindly agreed to receive parties of members at their works during the forthcoming Autumn Meeting. The names of other firms may subsequently be added to this list.

Allen (Edgar) and Co., Ltd., Sheffield.
Bolton (Thomas) and Sons, Ltd., Froghall.
Brightside Foundry and Engineering Co., Ltd., Sheffield.
British Iron and Steel Research Association Laboratories, Sheffield.
Brown (David) and Sons (Huddersfield) Ltd., Huddersfield.
Brown (David) Foundries Co., Penistone.
Davy and United Engineering Co., Ltd., Sheffield.
Derbyshire Silica Firebrick Co., Ltd., Friden, near Buxton, Derbyshire.
English Steel Corporation, Ltd., Sheffield.
Enthoven (H. J.) and Sons, Ltd., Darley Dale Smelter, South Darley, Derbyshire.
Firth (Thos.) and John Brown, Ltd., Sheffield.
Firth-Brown Tools, Ltd., Sheffield.
Firth-Vickers Stainless Steel, Ltd., Sheffield.
Hadfields, Ltd., Sheffield.
Mappin and Webb, Ltd., Sheffield.
Millspaugh, Ltd., Sheffield.
Oakes, Turner and Co., Ltd., Sheffield.
Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield, Notts.
Solus-Schall, Ltd., Matlock.
Steel, Peech, and Tozer, Sheffield.
Stephenson, Blake and Co., Ltd., Sheffield.
United Steel Companies, Ltd., Swinden Laboratories, Rotherham.
Walker and Hall, Ltd., Sheffield.

Further details of the meeting programme will be published shortly. Meanwhile members are reminded that a limited amount of accommodation for single and married members will be available in the University Halls of Residence at Sheffield during the Autumn Meeting at Buxton. The facilities are as good as at many second-class hotels. The charge for bed and breakfast is 16s. per day for the first three days and 12s. per day thereafter. It is desirable that early application should be made, preferably before June 30, if

reservations are required. Late applications may be received up to August 31, but a reservation cannot then be guaranteed.

Transport will be provided, free of charge, between Sheffield and Buxton for those registered as attending the Autumn Meeting.

Joint Metallurgical Societies' Meeting in Europe

All members will shortly receive a circular regarding the joint meeting between American and European metallurgical societies to be held in the first half of June. This will contain the programme of discussions and the conditions under which members of the Institute may participate.

Symposium on "The Mechanism of Phase Transformations in Metals"

A one-day Symposium on "The Mechanism of Phase Transformations in Metals," organized by the Metal Physics Committee, will be held at the Royal Institution, Albemarle Street, London, W.1, on Wednesday, 9 November 1955.

The Committee has invited a number of short papers which will be available in preprint form some weeks before the meeting. The papers will subsequently be reprinted, together with a summary of the discussion, in the Institute's Monograph and Report Series. No further papers can now be accepted.

Election of Members

The following 26 Ordinary Members, 4 Junior Members, and 4 Student Members were elected on 10 February 1955:

As Ordinary Members

BAKER, Stanley George, B.Sc., Lecturer in Engineering, Engineering Department, Stafford Technical College, Stafford.
BRAMPTON, Edward Charles, Refractories Engineer, General Refractories, Ltd., Sheffield 10.
CLARK, Paul William, Ph.D., B.Met., Refractories Engineer, The Derbyshire Silica Firebrick Co., Ltd., Friden, Hartingdon, near Buxton, Derbyshire.
CUSCOLECA, Otwin, Dipl.Ing., Technical Director, Oesterreichisch-alpine Montangesellschaft, Bartensteingasse 8, Wien 1, Austria.
EKLUND, Bror Sune, Dipl.Ing.Ch.E., Technical Intelligence Officer, Stora Kopparbergs Bergslags AB, Falun, Sweden.

ELLSWORTH, Ralph E., A.B., B.S., Ph.D., Director of Libraries, State University of Iowa, Iowa City, Iowa, U.S.A.

FORNANDER, Sven Gustaf Edwin, Bergsing., Technical Director, Jernkontoret, Stockholm C, Sweden.

GILCHRIST, John Kirkland, B.Sc., A.R.T.C., A.I.M., Lecturer in Metallurgy, Paisley Technical College, George Street, Paisley, Renfrewshire.

GREENWOOD, Arthur, Metallurgist, The Fairey Aviation Co., Ltd., Hayes, Middlesex.

HACKETT, Frederick John, B.Sc., M.I.Mech.E., Registered Patent Agent, The Loewy Engineering Company, Ltd., Manfield House, Strand, London, W.C.2.

HOWAHR, Erich, Managing Director, Maschinenfabrik Sack, G.m.b.H., Düsseldorf-Rath, Germany.

LENEL, Professor Fritz Victor, Ph.D., Professor of Metallurgical Engineering, Rensselaer Polytechnic Institute, Troy, N.Y., U.S.A.

LEVY, Felix Lewis, Company Director (Scrap Iron, Steel and Metal Merchants), Broadway Chambers, Hammersmith, London, W.6.

LOZZI, John A., Project Engineer, Titeflex, Inc., Hendee Street, Springfield 4, Mass., U.S.A.

MAYBANK, John Richard Charles, Controlling Director, Maybank Metals, Ltd., Deptford Wharf, Greenwich High Road, London, S.E.10.

MELLOR, George Fred, Works Metallurgist, Daniel Adamson and Co., Ltd., Dukinfield, Cheshire.

PAUL, Ronald Peter John, Works Director, William Jones, Ltd., Westmoor Street, Charlton, London, S.E.7.

PERKINS, George, B.S., Ph.D., General Director, Product Development, Reynolds Metals Company, 2500 South Third Street, Louisville 1, Ky., U.S.A.

PERRINE, Ralph J., Mechanical Engineer, Electric Furnace Company, Salem, Ohio, U.S.A.

SAVAGE, John, B.Sc., F.Inst.P., Head of the Physics Department, British Iron and Steel Research Association, 140 Battersea Park Road, London, S.W.11.

SMITH-CHRISTENSEN, Thorstein, Dipl.Ing., Managing Director, Thorstein Smith-Christensen, Kristinelundvei 6, Oslo, Norway.

SPENS, John Ivan, Chairman, London Tin Corporation, Ltd., 4b Frederick's Place, Old Jewry, London, E.C.2.

WILDE, Richard Arnold, M.S., Chief Metallurgist of Detroit Laboratory, Eaton Manufacturing Company, 9771 French Road, Detroit 13, Mich., U.S.A.

WILLIAMSON, Lawrence Joseph, A.Met., A.I.M., A.M.Inst.F., Metallurgist, Joseph Gillott and Sons, 3 Silverdale Road, Sheffield.

WISTREICH, John George, M.Sc., D.I.C., A.M.I.Mech.E., Research Engineer, British Iron and Steel Research Association, Hoyle Street, Sheffield 3.

ZENER, Clarence, Ph.D., Research Laboratory, Westinghouse Electric Corp., East Pittsburgh, Pa., U.S.A.

As Junior Members

FOX, John Gerald Maurice, B.Sc., Research Assistant, British Non-Ferrous Metals Research Association, 81-91 Euston Street, London, N.W.1.

LATHWOOD, Frederick Colin, Assistant Metallurgist, Ruston and Hornsby, Ltd., Spike Island Foundry, Lincoln.

MCGARRITY, Thomas, B.Sc., A.R.T.C., Metallurgist, Metallurgical Laboratory, Singer Manufacturing Company, Ltd., Singer, Clydebank, Scotland.

THORLEY, Alan, Student, Department of Metallurgy, University of Manchester.

As Student Members

BROWN, Keith Leonard, Laboratory Assistant (Met.), Aston Chain and Hook Co., Ltd., Bromford Lane, Erdington, Birmingham 24.

HORTON, Charles Terence, Assistant (Scientific), S.M.M. Building A5, Atomic Weapons Research Establishment, Aldermaston, Berkshire.

PHELPS, Leonard Arthur, Student Metallurgist, Metallurgy Research Department, Birmingham Small Arms Company, Ltd., Armoury Road, Small Heath, Birmingham 11.

RICHARDS, Jeffrey Roy, Undergraduate, Department of Metallurgy, University of Sheffield.

The following 18 Ordinary Members and 14 Student Members were elected on 4 March 1955:

As Ordinary Members

BOGGUST, Alfred Genever, Technical Officer (Met.), Strip Rolling Mill, Imperial Chemical Industries, Ltd., Metals Division, Kynoch Works, Birmingham 6.

COULTON, Frank A.M.I.Mech.E., General Manager (Engineering), Salem Engineering Co., Ltd., Milford House, Milford, Derby.

CRAWLEY, Arthur William, Metallurgist, J. Lucas (Gas Turbine Equipment), Ltd., Wood Top Works, Burnley, Lancs.

FRITZLEN, Glenn Arthur, B.S., Met.E., Assistant Technical Director, Development and Technical Services, Haynes Stellite Company, Kokomo, Ind., U.S.A.

GINSBURG, Kenneth Malcolm, B.Sc., A.C.T. (Birm.), A.I.M., Assistant Lecturer, Department of Metallurgy, University of Manchester.

GOLDSMITH, J. M., Sheffield Steel Division, Armco Steel Corporation, Kansas City 25, Mo., U.S.A.

GREEN, Simon, B.A., Managing Director, E. Green and Son, Ltd., Economiser Works, Wakefield, Yorks.

HOCEPIED, Jean B. F., Ingénieur-Conseil, 14 Rue des Receveurs, Bruges, Belgium.

HOPKINS, Alan D., M.Sc., A.I.M., Metallurgist, G.K.N. Group Research Laboratory, Birmingham New Road, Lanesfield, Wolverhampton, Staffs.

HUNTER, Raymond E., Plant Manager, Eureka Metals Supply Co., Riverside Division, 1501 Columbia Avenue, P.O. Box 667, Riverside, Calif., U.S.A.

MARCH, Emeri, Lic. ès Sc., I.E.G., Ingénieur-Métallurgiste, Chef du Service des Méthodes aux Usines de Toulouse, Société Nationale de Constructions Aéronautiques du Sud-Est (SNCASE), Toulouse, France.

MOXEY, D. E., Engineer, Moxey Conveyor Co., Ltd., 13 Augustus Road, Birmingham.

SMITH, Charles Sydney, Jr., B.S., Sc.D., Associate Professor of Physics, Case Institute of Technology, Cleveland 6, Ohio, U.S.A.

STEINRÖDER, Fritz, Dr.rer.pol., Direktor, Didier-Werke A.G., Lessingstrasse 16, Wiesbaden, Germany.

TREHARNE, Glynmor John, M.Sc., A.R.I.C., Scientific and Technical Manager, Batchelor, Robinson & Co., Ltd., Nevill's Dock, Llanelly.

VANN, Alfred Ernest, Managing Director, Lavino (London), Ltd., 103 Kingsway, London, W.C.2.

WALKER, Ian Gray Frederick, A.I.M., Chief Metallurgist and Chemist, Humber, Ltd., Stoke, Coventry.

WETHERLY, Donald Edmund, A.I.M., Metallurgist, British Iron and Steel Research Association, 140 Battersea Park Road, London, S.W.11.

PERSONAL NOTES

As Student Members

- BILLINGTON, (Miss) Sheila Ruth, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- BOLER, Robert, Undergraduate, Metallurgy Department, University of Sheffield.
- GOULD, David S., M.S., Graduate Student, Metallurgy Department, Missouri School of Mines, Rolla, Mo., U.S.A.
- KESSEL, Thomas Michael, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- KNIGHT, Ian Colin, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- LINFORD, John Richard Geoffrey, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- LUKOWICZ, Arthur F., Student, Illinois Institute of Technology, Chicago, Ill., U.S.A.
- SEVIER, P. E., Student of Metallurgy, Royal School of Mines, London, S.W.7.
- SLADE, Derek Roy, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- SMITH, Donald Strachan, Student of Metallurgy, Royal Technical College, Glasgow.
- WAINWRIGHT, Harry, Jr., Student, Missouri School of Mines and Metallurgy, Rolla, Mo., U.S.A.
- WARDEN, Graham Philip, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- WELLS, Trevor Charles, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- WYNNE, Edward Jeffrey, Student of Metallurgy, 40 Ferndale Avenue, Wallsend, Northumberland.

PERSONAL NOTES

DR. ERNEST A. BLOCH has now moved from Chippis to Neuhausen, and his address is Forschungsinstitut, Aluminium-Industrie A.G., Neuhausen-am-Rheinfall, Switzerland.

MR. GEORGE B. FOOTE has been appointed Managing Director of Southern Aluminium, Ltd., Sydney, Australia. He was formerly General Manager.

PROFESSOR J. NEILL GREENWOOD, of the University of Melbourne, accompanied by Mrs. Greenwood, will be in England from the first week in April until the last week of October. His address for correspondence will be c/o National Bank of Australasia, Strand, London, W.C.2.

MR. D. H. HOUSEMAN, who was recently awarded the Ph.D. degree of Cambridge University, has been elected to the W. J. Rees Research Fellowship in refractory materials at Sheffield University.

DR. M. VAN LANCKER has been awarded the degree of Docteur d'Etat ès Sciences of the Sorbonne, with highest honours.

MR. E. W. LOVERING has been appointed Metallurgical Engineer to the Scovill Manufacturing Co., Waterbury, Conn.

MR. T. B. MASSALSKI has been awarded the Ph.D. degree of Birmingham University and is now a Post-Doctoral Fellow at the Institute for the Study of Metals, Chicago.

MR. N. H. POLAKOWSKI is now Consulting Engineer to the La Salle Steel Co., Hammond, Ind., and lecturer in the Department of Metallurgical Engineering, Illinois Institute of Technology, Chicago, Ill.

MR. C. W. RIDGE has been appointed Managing Director of F. Issels and Son, Ltd., Bulawayo, Southern Rhodesia.

MR. C. J. WILLIAMS has been appointed Manager, Castings Division, High Duty Alloys, Ltd., Slough.

PROFESSOR DR.-ING. A. VON ZEERLEDER, who recently attained the age of 65, is retiring from whole-time business activity this year. He joined the Research Department of Aluminium Industrie A.G., Neuhausen, in 1920 and has also been a professor at the Eidgenössische Technische Hochschule, Zürich, since 1930. He was for many years Corresponding Member to the Council for Switzerland.

Deaths

The Editor regrets to announce the deaths of:

PROFESSOR CHARLES OLDEN BANNISTER, Emeritus Professor of Metallurgy in the University of Liverpool, on 22 February 1955. He was an Original Member of the Institute.

MAJOR ARTHUR EDWARD POWER, R.E., B.Sc., Managing Director of Celnik and Power, Ltd., on 19 January 1955. He had been a member of the Institute since 1920.

LETTERS TO THE EDITOR

Non-Equilibrium Structures in a Titanium-Base Alloy

The interpretation of the photomicrograph presented by Mr. Polonis and Dr. Parr¹ appears to be at variance with available published data. Their assertion that recognition of titanium-alloy structures is difficult is well taken; similar structures in a titanium-chromium-iron alloy were incorrectly interpreted by the present writer.²

There is sufficient information to indicate that a much higher rate of cooling than that employed in the case in question is necessary to suppress the $\beta \rightarrow \alpha + \beta$ diffusion-controlled nucleation and growth reaction in titanium alloys of similar solute nature and content. Martens,³ utilizing Greninger's technique,⁴ has determined that samples of Ti-1.50A (Ti-2.7% Cr-1.3% Fe) cooled at rates less than 540° C./sec. exhibit two thermal arrests, one at about 790° C., presumably the initiation of $\beta \rightarrow \alpha + \beta$ by nucleation and growth, and one at 515° C., the martensitic transformation $\beta \rightarrow \alpha'$. At higher cooling rates, the $\beta \rightarrow \alpha + \beta$ reaction was suppressed, and only the 515° C. arrest was observed.

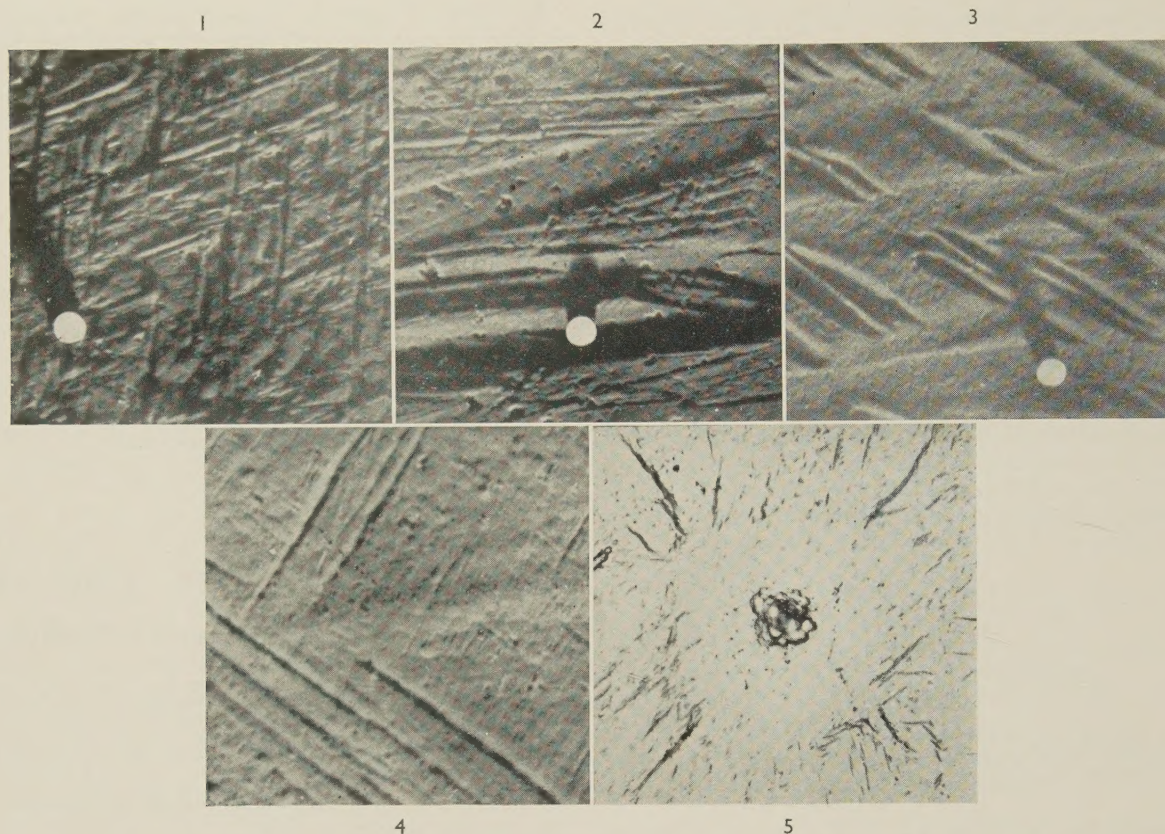
These results are in agreement with the isothermal-transformation experiments on this and other alloys^{2, 5-10} which show very short minimum transformation times for relatively dilute solute concentrations. Moreover, as the transformation temperature decreases, the α lamellae become increasingly fine and more linear, until distinction from α' is difficult. Since nucleation of the α which later grows to a feather-like structure is localized at β grain boundaries (Fig. 4, Ref. 2), a fairly reliable method of detecting this mode of transformation is available. Such a boundary is noted in Polonis and Parr's photomicrograph.

At certain cooling rates it is possible for different areas of a sample to show both transformation products. Figs. 1 and 2 are electron micrographs of a 3-mm.-thick sample of Ti-150A, oil-quenched from the all- β condition, showing, respectively, a region transformed by nucleation and growth and one transformed martensitically. These may be compared with an air-cooled and a brine-quenched sample (Figs. 3 and 4¹¹).

The black areas, which Polonis and Parr called α formed by nucleation and growth, are probably areas of titanium hydride

cooling described. The hydrogen content of titanium samples is not appreciably reduced by heat-treatment in a static vacuum.

The tendency to precipitate hydride in deformed regions even at room temperature is indicated in Fig. 5.¹¹ This shows an area under a Vickers hardness test impression after polishing almost to the base of the impression and re-etching. Coarse TiH forms along shear planes in the deformed region, probably causing the solution of some of the finer hydride particles in the vicinity. No heating followed the hardness test or polishing.



FIGS. 1-5.—Samples of Ti-150A, Containing Cr 2.22, Fe 1.01, Al 0.68, O 0.57, H 0.026, and W 0.2 wt.-%.

- FIG. 1.—0.5 hr. at 982° C. Oil-quenched. 3-mm. section. $\alpha + \beta$. Etched in 1:1 conc. HF and glycerol. Uranium-shadowed collodion negative replica. $\times 15,000$.
 FIG. 2.—Same sample as Fig. 1. α' . $\times 15,000$.
 FIG. 3.—1.0 hr. at 972° C. Air-cooled. 3-mm. section. $\alpha + \beta$. Etched in 1:1 conc. HF and glycerol. $\times 15,000$.
 FIG. 4.—1.0 hr. at 990° C. Quenched in aqueous 5% NaOH. 1-mm. section. α' . Etched in 2 parts conc. HF, 2 parts conc. HNO₃, 96 parts H₂O. $\times 15,000$.
 FIG. 5.—1.0 hr. at 982° C. Isothermally transformed 23.0 hr. at 372° C. Water-quenched. 3-mm. section. Fine $\alpha + \beta$ matrix not revealed by light etch, TiH precipitated on shear planes generated by deformation in vicinity of Vickers hardness test impression. Etched as Fig. 4. $\times 500$.

which over-etch readily. A recent extensive investigation of the binary titanium-hydrogen system¹² has revealed the characteristic microstructure of TiH in alloys with low concentrations of hydrogen, and also the high mobility of hydrogen at all temperatures and its marked decrease of solubility in α -titanium at temperatures below about 300° C. Several photomicrographs of titanium alloys have been published which undoubtedly show the hydride phase (Figs. 11-15, Ref. 2; Fig. 4, Ref. 13; Fig. 11, Ref. 14). The proclivity to cross grain boundaries, often without change of direction, should be noted. The properties of the hydride which have been cited would easily enable the phase to form during the vacuum-

In summary, then, the structure of the photomicrograph in question is not coarse Widmanstätten α in a matrix of subsequently formed α' , but a matrix of fine lamellar $\alpha + \beta$ formed by nucleation and growth from β during relatively slow cooling in which Widmanstätten TiH has precipitated after the $\beta \rightarrow \alpha + \beta$ reaction has been completed.

C. W. PHILLIPS

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 University of Michigan,
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REFERENCES

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We are interested to learn that Professor Phillips can be so positive that the material we identify as Widmanstätten α in our sample is, in fact, TiH. We would point out that:

(1) When the alloy, in powder form, is slowly cooled—and TiH would have every opportunity to precipitate—no acicular precipitate is formed. The structure consists of equiaxed grains of α .

(2) The black constituent in our photomicrograph is clearly formed above the M_s point. TiH precipitates below the M_s point.

(3) The "proclivity [of TiH] to cross grain boundaries, often without change of direction" is, indeed, a common observation. It will be seen that the black precipitate in our photomicrograph does not cross grain boundaries, and shows a marked change of direction in adjacent grains.

(4) As our only source of hydrogen is in the iodide bar-stock (and possibly in the iron), we would have expected the black precipitate to have occurred in several other alloys in which, in fact, none was observed.

These observations are consistent with our conclusion that the phase under discussion is Widmanstätten α . Further, in his conclusion, Professor Phillips interprets our structure as containing a "matrix of fine lamellar $\alpha + \beta$ ". X-ray-diffraction data show the structure to contain extremely little β ; and we cannot agree that the structure appears to be lamellar.

Incidentally, we find it difficult to accept Professor Phillips' interpretation of the electron micrographs reproduced in Figs. 1 and 2 of his letter.

D. H. POLONIS
J. GORDON PARR

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University of British Columbia,
Vancouver, B.C., Canada.

Observation of Metal Surfaces at High Temperatures in the Reflection Electron Microscope

The reflection technique of electron microscopy, originally devised by von Borries,¹ has recently been developed into a useful method for investigating the surface structure of metals.²⁻⁴ It permits direct observation of a specimen, instead of using replicas in transmission electron microscopy. The possibility is thus offered of following by reflection the surface

changes which accompany thermal, mechanical, or chemical treatments carried out on a metal *in situ*.

A successful attempt has now been made to accomplish the first of these, using the reflection microscope designed and built at the Cavendish Laboratory.^{5,6} A small furnace has been constructed in which metal specimens can be raised to temperatures as high as 1200° C. whilst under observation in the electron beam. It is fixed to the normal specimen port of the microscope and is provided with the essential stage motions for exploring the surface: two translations perpendicular to the beam and a rotation in azimuth. Specimens of a size (6 mm. long and 6 mm. dia.) suitable for metallurgical studies can be accommodated. A full description of the furnace is being published elsewhere.⁷

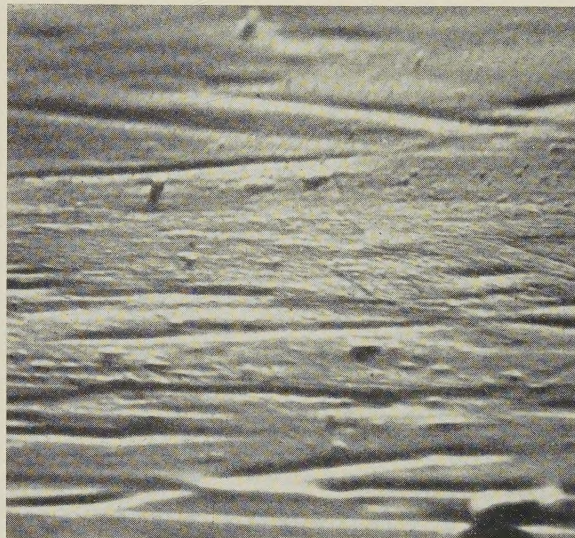


FIG. 1.—Reflection Electron Micrograph of Polished Silver Surface at 450° C. $\times 2000$. Beam at grazing angle of 1°; observation at 4° to surface; voltage 60 kV.

It is the purpose of the present communication to draw attention to the extension of reflection electron microscopy to high temperatures, which should provide a valuable supplement to the existing optical methods. The furnace has been tested up to 1190° C., and electron micrographs have been obtained from silver (Fig. 1) and other metal surfaces. In the case of silver, the changes observed are most probably to be ascribed to thermal etching under the vacuum conditions prevailing, but signs of surface flow appear above 900° C.

This research was carried out during the tenure of a Bursary from the British Iron and Steel Research Association, to whom thanks are also due for a grant towards the cost of apparatus.

D. JONES

Cavendish Laboratory,
Cambridge.

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NEWS OF LOCAL SECTIONS AND ASSOCIATED SOCIETIES

Birmingham Local Section

Christmas Lecture

The second annual Christmas Lecture arranged by the Birmingham Local Section was delivered by Dr. W. O. ALEXANDER on the afternoon of 13 December. Entitled "Metallurgy and its Kindred Sciences", the lecture attracted some 300 senior boys and girls from Grammar and similar schools in the City and neighbouring districts.

Dr. Alexander introduced his lecture with an account of the history and functions of the Institute of Metals. Turning to the lecture proper, he likened the sciences to adjacent cells in a honeycomb structure, metallurgical knowledge being built up by means of techniques adapted from each of the pure and applied sciences surrounding it.

Dr. Alexander then gave a simple account of the formation of matter from its atomic constituents and the build-up of these atoms into metallic lattices. Alloying was introduced as "playing about with the lattices" and its effect demonstrated by the increasing stiffness of strips of pure and alloyed aluminium. Changes in the space lattice giving rise to allotropic forms of metals were mentioned, and the action of irradiated metal in a Geiger counter was demonstrated. A mercurous nitrate test for season-cracking in a brass tube was used to illustrate some remarks on the crystalline properties of metals, and the comparative creep rates of pure and alloyed lead were exhibited and discussed.

The effect of fatigue on metals and the directionality of mechanical properties of worked materials were mentioned, as was the part being played by powder metallurgy in the production of special alloys, ferrites, &c. Slides and specimens were employed to illustrate the troubles caused by corrosion, and an account of the failures of paravane cables given to demonstrate the phenomenon of corrosion-fatigue. An account of the building up of metals into engineering structures and some discussion of the metallurgical problems encountered in the development of sources of atomic energy concluded the main part of the lecture.

Finally, Dr. Alexander outlined some of the fields of metallurgy in which persons with scientific training of a general nature could participate and enumerated the main qualifications which should be aimed at by those seeking responsible positions in the industry.

London Local Section

At a meeting of the Section held at 4 Grosvenor Gardens, London, S.W.1, on 3 February, Dr. W. E. HOARE (Assistant Director of the Tin Research Institute) gave a talk entitled:

Tin and Tinplate

After quoting some figures indicating the size of the tinplate industry—production last year was nearly one million tons and utilized 60,000 tons of primary tin—Dr. Hoare gave details of some of the new packs made possible by the generally improved metallurgical quality of tinplate steels and by the ingenuity of can manufacturers. Examples of these were cans for beer and carbonated beverages, and pressurized containers for aerosols. An even more recent development was canned wine, now marketed in the U.S.A.

Dr. Hoare then described some of the recent advances in

tinplate manufacturing technique, particularly mentioning continuous-strand annealing and electrolytic tinplate.

Two films were shown to illustrate some of the researches being carried out at the Tin Research Institute. The first film showed the operation of a laboratory apparatus designed to simulate the production of electrolytic tinplate; the second illustrated the development of an improved corrosion test for tinplate known as the hydrogen rate test.

South Wales Local Section

At a meeting of the Section held at University College, Swansea, on 8 February, Mr. E. JOHNSON (William Jessop and Sons, Ltd.) lectured on:

Tool and Die Steels

The lecturer described the composition, properties, and other metallurgical characteristics of selected tool and die steels used in the production of mainly non-ferrous metals. Operations considered included cold and hot extrusion, cold drawing and heading, blanking and shearing, drawing, die-casting, forging, and machining, and a correlation of the principal characteristics of the steels with their use in these applications was attempted.

It was pointed out that often the choice was not limited to one particular steel and that many factors had to be considered in a final selection, not least being past experience. The causes of failure of certain specific items made of standard steels were discussed, and the composition, treatment, and properties of some new improved steels were given.

JOINT ACTIVITIES

Mond Nickel Fellowships

The Mond Nickel Fellowships Committee invites applications for the award of Mond Nickel Fellowships for the year 1955. Awards will be made to selected applicants of British nationality educated to University degree or similar standard, though not necessarily qualified in metallurgy, who wish to undergo a programme of training in industrial establishments; they will normally take the form of travelling Fellowships, though awards for training at Universities may be made in special circumstances. There are no age limits, but awards will seldom be given to persons over 35 years of age. Each Fellowship will occupy one full working year. The Committee hope to award up to five Fellowships each year, of an approximate value of £900 to £1200 each.

Mond Nickel Fellowships will be awarded in furtherance of the following objects:

(a) To allow selected persons to pursue such training as will make them better capable of applying the results of research to the problems and processes of the British metallurgical and metal-using industries.

(b) To increase the number of persons who, if they are subsequently employed in executive and administrative positions in the British metallurgical and metal-using industries, will be competent to appreciate the technological significance of research and its results.

(c) To assist persons with qualifications in metallurgy to obtain additional training helpful in enabling them ultimately to assume executive and administrative positions in British metallurgical and metal-using industries.

(d) To provide training facilities whereby persons qualified

in Sciences other than Metallurgy may be attracted into the metallurgical field and may help to alleviate the shortage of qualified metallurgists available to industry.

Applicants will be required to state the programme of training in respect of which they are applying for an award, as well as particulars of their education, qualifications, and previous career. Full particulars and forms of application can be obtained from: The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1. Completed application forms are required to reach the Secretary of the Committee not later than 1 June 1955.

OTHER NEWS

Aluminium Exhibition 1955

An Aluminium Exhibition is to be held at the Royal Festival Hall, London, S.E.1, from 1 to 11 June this year to mark the progress the aluminium industry has made. It is just a century since the first aluminium was produced in Great Britain—as a laboratory curiosity at the Royal Institution—and half a century since Wilm discovered the age-hardening of Duralumin. It is also ten years since the "From War to Peace Exhibition" was held, at which one of the most popular attractions was the prototype of the aluminium prefabricated house; more than 70,000 of these houses were subsequently built.

The 1955 Exhibition, which is being organized by the Aluminium Development Association, is directed primarily to the present and potential users of aluminium in the engineering and general industries of the country, to professional organizations, and to those interested in higher education. It will not be a public exhibition in the general sense, but members of the Institute wishing to receive invitations should communicate with the A.D.A. at 33 Grosvenor Street, London, W.1.

The Exhibition will include an historical section and also a section devoted to the part that research has played in building up the industry to its present level. The processes of extraction of aluminium and its fabrication will be summarized, and a concluding section of the Exhibition will be devoted to the future of the metal and its applications.

The largest part of the Exhibition will deal with the present-day uses of aluminium, and will set out to answer the question: "Why is aluminium used for. . . ?" This section—divided into twelve main fields of application—will be illustrated not only by photographs, drawings, and models, but also by actual examples of road and rail vehicles, boats, chemical plant, electrical equipment, packaging items, general engineering products, and farming and food-handling equipment. It will be shown that many applications accepted as commonplace to-day were merely ideas even as recently as ten years ago.

A visit to the Exhibition is being included in the programme of the members of American metallurgical societies who will be in Britain at that time. It is also intended to arrange special discussions for different industries on many of the days on which the Exhibition is open.

Joint I.M.E.-A.S.M.E. Conference on Combustion

A Conference on Combustion, jointly organized by the Institution of Mechanical Engineers and the American Society of Mechanical Engineers, is to be held in Boston, Mass., on 15-17 June and in London on 25-27 October 1955.

The objects of the Conference are to link theory and practice in the combustion field by presenting the results of theoretical work to practical engineers in America, Great Britain, and other countries; and to provide an opportunity for engineers in these countries to meet and discuss practical applications of theory in the fields of boilers, industrial furnaces, internal-combustion engines, and gas turbines.

Discussions will centre round some 45 papers, which have been invited and which will be presented by rapporteurs at both the Boston and London meetings. Preprints of the papers are expected to be available in April and a volume of proceedings will subsequently be published, containing the papers and discussion. A set of preprints, together with one copy of the proceedings volume, will cost £2 12s. 6d.

It is expected that some 30 Institutions and Societies (including the Institute of Metals) from Great Britain, the Commonwealth, and Europe will support the Conference, in addition to a number from the United States. Access to the various sessions and facilities for purchasing literature relating to the Conference will be open to members of all the participating Institutions and Societies.

Details may be obtained from The Secretary, The Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1.

Conference on Non-Destructive Testing

An International Conference on the Non-Destructive Testing of Materials is to be held in Brussels on 23-28 May 1955, under the auspices of the Association des Industriels de Belgique. The aim of the conference is to discuss the present state of non-destructive testing methods from the standpoint of scientific research, industrial applications, and education. It will also deal with international co-operation by exchange of information. Technical sessions are being arranged for 24-26 May, and visits will take place on 29 May to laboratories and educational institutions in Brussels, Mons, and Charleroi.

The Secretary of the Organizing Committee is M. Georges de Rees, A.I.B., 29 Avenue André-Drouart, Auderghem, Brussels, Belgium.

Powder Metallurgy Seminar

The Second International Plansee Seminar "De re metallica" will be held in Reutte-Tyrol from 20 to 23 June 1955. The theme of the seminar will be "High-Temperature Materials by Powder Metallurgy".

Summer School of Welding

The fifth Summer School of Welding, organized by the British Welding Research Association, will be held at Ashorne Hill, near Leamington Spa, Warwickshire, from Monday, 27 June, to Saturday, 2 July 1955. The theme of the course this year will be "Welding Developments in British Industry". The school is open to all, and details may be obtained from B.W.R.A., 29 Park Crescent, London, W.1.

Fifth World Power Conference, 1956

The Fifth World Power Conference will be held in Vienna from 17 to 23 June 1956. The theme of the conference will be: "World Energy Resources in the Light of Recent Technical and Economic Developments".

Enquiries concerning the conference should be addressed to: Oesterreichisches Nationalkomitee der Weltkraftkonferenz, Schwarzenbergplatz 1, Vienna I, Austria.

Conference on the Physics of Nuclear Reactors, 1956

The Institute of Physics is arranging a Conference on "The Physics of Nuclear Reactors" to be held in London on 3-6 July 1956. The President of the Institute (Sir John Cockcroft) will open the Conference with an address on the "Scientific Problems in the Generation of Nuclear Power". The primary purpose of the Conference is to keep members of the Institute of Physics, particularly those engaged in industry, informed about recent developments in reactor physics and the cognate scientific and technical subjects, and to tell them of the problems awaiting solution. A limited number of non-members will be able to attend the Conference by invitation. Further details will be announced in the autumn of 1955, including the procedure by which non-members may be considered for invitations to attend the Conference.

DIARY

Other Societies

- 15 April. Institution of Mechanical Engineers.** "Surface Examination by Reflection Electron Microscopy", by Dr. J. S. Halliday. (The Institution, Birdcage Walk, London, S.W.1, at 5.30 p.m.)
- 21 April. Institution of Mining and Metallurgy.** General Meeting. (Geological Society, Burlington House, Piccadilly, W.1, at 5.0 p.m.)
- 22 April. Institute of Physics, Non-Destructive Testing Group.** "Notes on the Principles of Ultrasonic Testing", W. Halliday and A. C. Rankin. (47 Belgrave Square, London, S.W.1, at 6.30 p.m.)
- 27 April. Society of Chemical Industry, Corrosion Group.** Annual General Meeting, followed by Chairman's address by Dr. J. C. Hudson. (Chemical Society, Burlington House, Piccadilly, W.1, at 6.30 p.m.)
- 6 May. Institute of Physics, Non-Destructive Testing Group.** "Xeroradiography", by R. L. Durant. (47 Belgrave Square, London, S.W.1, at 6.30 p.m.)

APPOINTMENTS VACANT

ASSISTANT METALLURGIST or chemist is required for research work on high-temperature materials, hard metals, and cutting-tool materials. Applicants should preferably have had previous experience of laboratory work and should possess a metallurgical or chemical degree, a Higher National certificate, or equivalent qualification. Apply, quoting reference HM, and stating age, qualifications, and experience, to Director of Research, The British Thomson-Houston Co., Ltd., Rugby.

METALLURGISTS having a good Honours degree, and preferably with research experience, are required for research on materials for use at high temperatures and also on hard metals and cutting-tool materials. Apply, quoting reference HM, and stating age, qualifications, and experience, to Director of Research, The British Thomson-Houston Co., Ltd., Rugby.

METALLURGIST is required for investigation of problems in the field of physical metallurgy. The vacancy would suit a recent graduate—one or two years' industrial or research experience would be an advantage, but is not essential. Applications should be addressed to The Director of Research, Aluminium Laboratories Limited, Banbury, Oxon.

METALLURGIST required to join a team engaged on research into the manufacture and properties of wrought metals and alloys, at the Metal Working Laboratories of the British Iron and Steel Research Association in Sheffield. Applicants, aged 22-26, should have good degree, be keenly interested in research and willing to further their knowledge of metallurgy and metal physics as applied to the plasticity of metals. Commencing salary up to £750 p.a.,

depending on age and qualifications. Post is superannuated under the F.S.S.U. Written applications only, quoting "Metal Working", to Personnel Officer, B.I.S.R.A., 11, Park Lane, London, W.1.

PHYSICAL METALLURGIST required for programme of laboratory investigational work on alloys in the Research Laboratory of Imperial Smelting Corporation. A degree or equivalent qualification in metallurgy is required, together with at least one year's experience of the practical application of physical-metallurgy work, preferably in a Research Department. This is a Senior Staff appointment, superannuated, and commencing salary will be entirely dependent upon individual qualifications and experience. Applications to Personnel Manager, Imperial Smelting Corporation, Ltd., Avonmouth, quoting reference LRM/IM.

THE RESEARCH LABORATORY of the British Thomson-Houston Co., Ltd., requires a graduate in metallurgy or physics to join an expanding group working on the strength of metals, with particular reference to high-temperature properties. Apply, quoting reference HJ and stating age, qualifications, and experience to the Director of Research, The British Thomson-Houston Co., Ltd., Rugby.

PHYSICIST required for X-ray diffraction and other interesting physical investigations, in a Metallurgical Research Laboratory. Good prospects and scope exist. Pension scheme. Apply, giving full particulars of age, qualifications, and experience, to Box No. 387, The Institute of Metals, 4 Grosvenor Gardens, London, S.W.1, quoting reference PX.

UNIVERSITY OF NOTTINGHAM LECTURER IN METALLURGY

Applications are invited for the appointment of a Lecturer in Metallurgy. Candidates should have a good Honours degree in Metallurgy and preferably also works experience. Salary: immediate appointment in the range of £650-£1050, with possible advancement to £1350; Superannuation (Federated Superannuation System for Universities) and family allowance. Conditions of appointment and form of application from the undersigned.

H. PICKBOURNE,
Registrar.

COMMONWEALTH OF AUSTRALIA APPOINTMENT No. 370/90 OF PHYSICIST OR METALLURGIST (THREE-YEAR PERIOD) DIVISION OF TRIBOPHYSICS

The Commonwealth Scientific and Industrial Research Organization invites applications from physicists or metallurgists for appointment to a position of RESEARCH OFFICER to work with the solid-state group of the Division of Tribophysics, located at the University of Melbourne. This group is concerned with problems of plastic deformation and phase transformations. Initially, the appointment will be made for a period of three years, but it may be extended.

Qualifications: Research experience at least equivalent to Ph.D. standard is essential. Some experience in the field of nuclear magnetic resonance would be an advantage.

Salary: Dependent on qualifications and experience, commencing salary will be determined within the range of Research Officer, £A 1184-£A 1730 p.a., and an applicant would be appointed at a commencing salary of not less than £A 1394 p.a., according to qualifications and experience.

Fare to Australia (including those of wife and family) will be paid, also return fares in cases where the appointee does not take up permanent appointment with C.S.I.R.O. at the expiry of his fixed period.

Applications, referring to Appointment No. 370/90 and stating full name, place, date and year of birth, marital state, nationality, particulars of qualifications and experience, and of war service, if any, accompanied by names and addresses of at least two persons willing to act as referees, if required, and copies of not more than four testimonials, should reach the undersigned not later than the 25 April 1955.

W. IVES,
Chief Scientific Liaison Officer.

Australian Scientific Liaison Office,
Africa House,
Kingsway,
London, W.C.2.

METALLURGICAL TRANSLATIONS from French, German, and Italian undertaken by translator with considerable non-ferrous experience. 30/- per 1000 words. References supplied. Mrs. Secretan, M.A., 8 Cambridge Rd., Wimbledon, London, S.W.20.